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A FOLLOW-UP ANALYSIS OF
PARTICIPANTS IN THE
WATERLOO PRESCHOOL CHILDREN'S
DENTAL CARE STUDY

by

T. P. Howley, A. Glenny,
and D. W. Lewis

March 1980

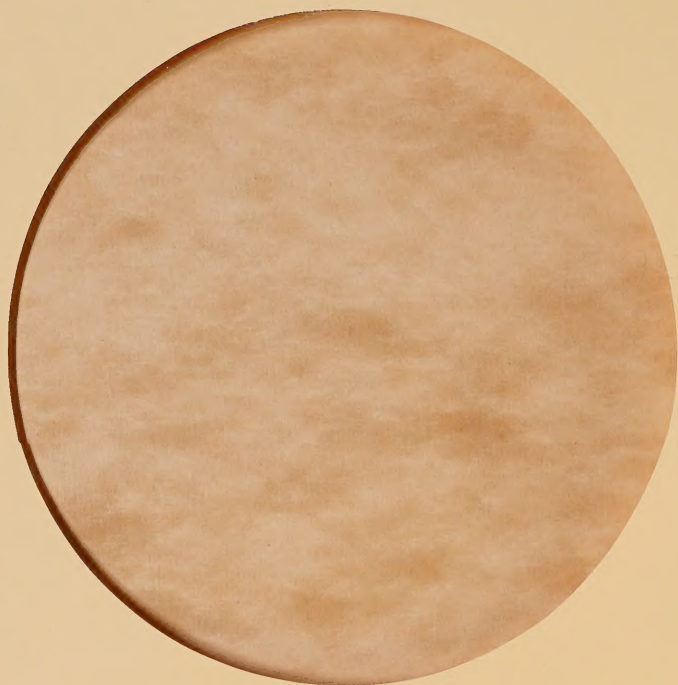
RESEARCH REPORT

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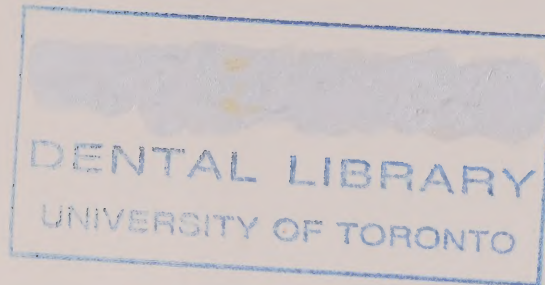
THE FACULTY OF DENTISTRY



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Research Report No. 33

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ABSTRACT

The present dental health status of three groups of children who had participated in a preschool dental care program was evaluated and compared with that of control subjects individually matched on age, sex, and school. One treatment group received complete dental care free of charge starting in 1971; the second group received free complete dental care starting in 1972; and the third group received free preventive and diagnostic care starting in 1972. The care was provided for three years.

No differences in dental health status were found among these three treatment groups that were not due to age. Several small, though statistically significant, differences were detected between the treatment children and their matched controls. Matched t-tests showed that the children in the treatment groups had more filled, treated, and total affected deciduous teeth than those in the control group. Multiway frequency table analyses using the log-linear model showed that both the child's age and the examining hygienist had a stronger association with the numbers of filled, treated, and total affected deciduous teeth than did the treatment or control status of the child.

The results from this study indicate quite clearly that the subsidized dental care programs for preschool children did not have any detectable beneficial long-term effects on the dental health of these children seven or eight years later.

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INTRODUCTION

The Waterloo Time, Cost and Manpower Study of Incremental Dental Care for Preschool Children was initiated in 1971 in the Regional Municipality of Waterloo, Ontario.¹ The purpose of the study was to demonstrate the feasibility of providing free dental care to preschool children utilizing the office facilities of private dental practitioners. Two cohorts of children were included in the project. The first cohort (Group I) of nearly 1,000 randomly selected three-year-old subjects received complete basic dental care (preventive, diagnostic and restorative) free of charge for three years commencing in 1971. The second cohort of nearly 1,000 three-year-old children was selected to start in 1972. This cohort was divided into two groups. Complete basic dental care was provided free of charge to about one-half of these children (Group II) but the remaining half (Group III) received free preventive and diagnostic care only, again for three years. The Waterloo Regional Health Unit administered the program and also provided some diagnostic and preventive care to the children. Services provided were recorded on a patient record which was used both as a bill for services and as a data source on the costs and time of providing the treatment.

General Purpose of this Study

The purpose of the current study was to follow up the three groups of experimental subjects to evaluate their present dental health status in

¹ The full results of this project are presented in the Waterloo Time, Cost and Manpower Study of Incremental Dental Care for Preschool Children, August, 1975 by D. W. Lewis, S. C. Magid, and M. E. Jarrett. A summary was published in the Journal of the Canadian Dental Association. J Canad Dent Assn, No 1, 1977

comparison with matched control subjects of the same sex, age, and school. The question is, simply put, are there now any residual differences between treated and control children that might be directly or indirectly attributable to the preschool care program? An earlier follow-up study done soon after these children reached school age revealed some small differences between treated and non-treated children.

Data Collection

The dental staff of the Waterloo Regional Health Unit carried out the collection of the data during the 1978-1979 school year. The children participating in the original project were located through the computer assisted school health record system at the Health Unit.

Of the 1,775 children in the three treatment groups who actually participated in the original study, 950 were individually matched with 'control' children of the same age, sex, and school who had not participated in the earlier treatment programs. Each child (whether in the treatment or control group) was examined by one of the dental hygienists on staff at the Health Unit. A dental assistant recorded (on a Canadian Dental Association Form D.H. 3, 1959 -- see Appendix A) the numbers of deciduous and permanent teeth which were previously extracted, needing extraction, previously filled, and needing filling. These tooth counts, along with the design variables treatment group, place of residence, sex, age, and examining hygienist were coded and keypunched for computer analysis. Complete and valid data for the tooth count variables were obtained from 909 matched treatment-control pairs. The remaining 41 matched pairs were excluded from the analysis. The distribution of this complete data sample

by various design variables is shown in Table 1. The one seven-year-old and two eight-year-olds were combined with the nine-year-olds in all the analyses, and the thirteen twelve-year-olds were combined with the eleven-year-olds. Three variables were created from the place of residence; these are called AREA, URBAN/RURAL, and FLUORIDE.

ANALYSIS OF THE DATA

Several new tooth count variables were created for use in the subsequent analyses. These are shown in Table 2, along with the abbreviations by which they are referred to in this report. The number of extractions (E or M) is simply the sum of the numbers of previous extractions (P) and needed extractions (C). (Note that, by convention, the deciduous extraction count is denoted by the letter "E", while the permanent extraction count is denoted by the letter "M".) Similarly, the number of treated (T) teeth is simply the sum of the numbers of previously extracted (P) and previously filled (F) teeth. Another set of tooth counts, the sums of the deciduous and permanent tooth counts, was created for each treatment and each control child. Finally, another complete set of 21 difference scores, the differences between the treatment counts and the matched control counts, was derived.

The distributions of all the tooth counts for the treatment and the control children were all very highly positively skewed and leptokurtic (for example, see Table 5) and could not be analyzed using normal statistical procedures. However, some of the difference scores were quite normally distributed, while some others could be transformed

to become approximately normal using a Likert-type recoding scheme. Still other difference score distributions had such large peaks at "zero" that normalizing transformations would not have preserved the metric information in the scores to a satisfactory degree. Examples of such non-normalizable, normalized and already normal distributions are shown in Table 3.

Analysis of Normally Distributed Treatment-Control Difference Scores

Generally, the decayed, filled, total affected, and treated difference scores were found to be normal or normalizable. Matched t-tests were performed to determine whether any of these difference scores were significantly different from zero. The results from these t-tests, along with other distributional statistics for the normal (or approximately normal) difference scores are presented in Table 4.

Significant differences ($P < 0.05$) were found between treatment and control children for deciduous tooth counts only. The treatment children are seen to have more filled ($P = 0.015$), total affected ($P = 0.029$), and treated ($P = 0.018$) deciduous teeth than their matched controls. These differences, though, are quite small, and the fact that they are significantly greater than what would be expected by chance does not indicate that they are important, especially given that the sample size is quite large ($N = 909$).

Several analyses of variance were performed (using the ANOVA procedure in the SPSS computing package) with the normally distributed difference scores as dependent variables. None of the design variables investigated (SEX, GROUP, AGE, AREA, URBAN/RURAL, FLUORIDE) had any

significant effect at all on these treatment-control difference scores.

Log-linear Analysis of Dichotomized Deciduous Tooth Variables

Multiway frequency classification analyses using the log-linear model were performed (using the BMDP 3F computing package) to analyze the non-normalizable treatment and control tooth count variables. This procedure is similar to the usual chi-square test in that associations among categorical variables are detected by comparing observed and expected frequencies. In addition, though, the use of logarithmic likelihood ratios allows the partitioning of various effects as in the analysis of variance.

The deciduous tooth count variables which would be treated as dependent variables in normal analyses (such as t-tests and analyses of variance) were dichotomized (see Table 5) and treated as classifying design variables in the log-linear analyses. The previously extracted, needing extraction, and total extracted counts were not used in these analyses, as there were so few cases in the "non-zero" category. The filled, total affected, and treated tooth counts were each dichotomized into a "zero" category and a "three or more" category, omitting counts of one or two teeth, so that only the extreme categories were compared. The decayed tooth count was dichotomized into a "zero" category and a "greater than zero" category.

Various multiway classification tables were examined, each using one of the dichotomized deciduous tooth variables with several of the design variables TREATMENT/CONTROL, AGE, SEX, GROUP, AREA, and EXAMINER. Generally, DECAYED did not show any significant associations, except

with AGE. FILLED showed very similar associations to those of TREATED; of these two only the TREATED variable needs to be mentioned in the remainder of this discussion.

The design variable TREATMENT/CONTROL generally showed associations with TOTAL AFFECTED, significant at about the $P = 0.02$ level, and associations with TREATED, significant at about the $P = 0.002$ level. SEX was associated with the TREATED and with the TOTAL AFFECTED variables at about the $P = 0.07$ to $P = 0.02$ level of significance, depending upon which other design variables were included in the analysis.

Because of the design of the original study, the variables GROUP and AGE were highly confounded (see Table 6). To control for this, the GROUP variable was used in the analyses in two ways. First, using the subsample of ten-year-olds, all three groups were included in various multiway tables. Second, using only nine- and ten-year-olds in groups II and III, the two levels of the GROUP variable and the two levels of the AGE variable were included in various multiway tables. Either way, no significant associations were observed between GROUP and any of the dichotomized tooth count variables.

Highly significant associations were found between EXAMINER and the dichotomized tooth count variables, but EXAMINER was also highly confounded with AGE and with AREA (both $P < 0.0001$). With respect to AREA, this does not lead to any difficulties in interpretation, as AREA was found not to be significantly associated with any of the dichotomized tooth count variables. But AGE was found to be associated to a highly significant degree with these tooth count variables. This

results in some uncertainty as to the relative magnitudes of the effects of age and the examining hygienist on the numbers of affected or treated teeth.

From all the above analyses, it was decided that the most important design variables associated with the dichotomized tooth variables were TREATMENT/CONTROL, AGE, SEX, and EXAMINER. The results of the multiway frequency classification analyses using these four design variables with the dichotomized tooth count variable TOTAL AFFECTED, and with the variable TREATED, are presented in Table 7, parts A and B, respectively. Only the two-variable associations are shown; the three-variable and higher associations as a whole were not significant.

The marginal two-way tables corresponding to the most significant two-variable associations in Table 7A are shown in Table 8. These tables show:

- The children who received some kind of free dental care were more likely to have a greater number of deciduous teeth affected than were their matched controls.
- There is a pronounced trend for the younger children to have greater numbers of deciduous teeth affected. This is most likely due to the fact that in the older children more deciduous teeth have been replaced with permanent teeth.
- The boys in the study were more likely to have a greater number of deciduous teeth affected than were the girls.
- The examining hygienist had apparently a great deal to do with the number of teeth reported as being affected. While examiners "3" and

"4" reported finding three or more affected deciduous teeth in more children than they reported finding no affected teeth, the other two examiners reported considerably fewer children having three or more affected teeth than having no affected teeth.

Analysis of Ratio Variables

In addition to examining the numbers of various kinds of affected teeth, it was of interest to study the ratios of the numbers of each kind of affected teeth to the total number of affected teeth. Thus, the 54 ratio variables displayed in Table 9 were created and analyzed.

Since it is not too meaningful to compare ratios having small denominators such as 2 with ratios having large denominators such as 10, the difference ratio scores were analyzed separately for the matched pairs in which both treatment and control had between two and four total affected teeth, and for the matched pairs in which both treatment and control had four or more total affected teeth. The crosstabulations of the total number of affected teeth for the treatment-control pairs are shown in Table 10.

No important differences were found between the treatment and control ratios that were consistent across the "two to four affected" and the "four or more affected" groups (see Table 11), so a more intensive analysis involving normalization of some of these difference ratios was not warranted.

SUMMARY AND CONCLUSIONS

The results from this follow-up study indicate quite clearly that the subsidized dental care programs for preschool children did not have any detectable beneficial long-term effects on the dental health of these children seven or eight years later. No differences between treatment and control children were found with respect to the number of permanent teeth affected, and the differences with respect to deciduous teeth, although significant, were very small, and, for affected teeth, in the opposite direction than had been hoped. The examining hygienist and the age of the child had considerably greater associations with the numbers of affected teeth than did the treatment or control status of the child. Finally, no treatment-control differences in the ratios of the various types of affected teeth to the total number of affected teeth were found.

The lack of differences between treatment and control group children reported here is not surprising in view of the length of time since the original study ended (1973 for Group I, 1974 for Groups II and III), and the findings of the earlier, limited follow-up study using school survey data of 1973-74 and 1974-75. This original follow-up study, on children in kindergarten, grade 1, and grade 2, indicated about the same number of teeth attacked by decay in treatment and control children, and slightly higher filling rates (F/DEF) in treatment (Group I) over control children. Furthermore, the children only partially subsidized for care (Group III) had obtained more additional treatment, at their own expense, than had the fully subsidized children (Group II).

Thus, it would have been reasonable to speculate that more complete data gathered in 1978-79 would show very few differences.

Apparently, the dental visit pattern of Waterloo Region children whose dental treatment was subsidized during their preschool years, varies little from that of other, unsubsidized children. This raises interesting questions about the real effects of subsidized care across all segments of the child population using private dental practice, and about the target group and ideal age for initiating subsidized care in an urban area like the Waterloo Region. This region is quite affluent and well-supplied with dentists, and apparently has relatively low dental decay in children's deciduous teeth. Also, in such a region, what differences would be found in disease attack and treatment received if the program had continued into the school-age years, keeping in mind that there were few differences obvious at school entry after the pre-school program?

The Waterloo study was not designed to answer such questions. However, the apparent ineffectiveness of the Waterloo subsidized dental care program in improving dental health, and the high cost of such subsidization for the entire child population, both emphasize the need for answers to these questions before any large scale subsidized dental health care program for children is implemented.

TABLE 1

FREQUENCIES OF TREATMENT AND CONTROL SUBJECTS BY DESIGN VARIABLES

Variable		Name	Code	Category	Treatment N	Control N	Matching Variable	Total N
Description				Description				
Treatment Group		GROUP	1	1971 Complete Care (I)	429	429		858
			2	1972 Complete Care (II)	256	256		512
			3	1972 Preventive + Diagnostic Care (III)	224	224		448
				TOTAL (non-missing)	909	909	Yes	1,818
Place of Residence		AREA	1	Kitchener	474	474		948
			2	Waterloo	109	109		218
			3	Cambridge	181	181		362
			4	Ayr, North Dumfries, Bridgeport, Wellesley, Wellesley Twp.	46	46		92
			5	Woollich Twp., New Hamburg Waterloo Twp., Elmira, Wilnot Twp.	99	99		198
				TOTAL (non-missing)	909	909	Yes	1,818
Urban/Rural		URBRUR	1	Urban (Kitchener, Waterloo, Cambridge, Elmira)	784	784		1,568
			2	Rural	125	125		250
				TOTAL (non-missing)	909	909	Yes	1,818

TABLE 1

FREQUENCIES OF TREATMENT AND CONTROL SUBJECTS BY DESIGN VARIABLES

.... continued

Variable		Category		Treatment N	Control N	Matching Variable	Total N
Description	Name	Code	Description				
Fluoridated or Non-Fluoridated Area	FLUORIDE	1	Fluoridated (Waterloo + Wellesley)	116	116		232
		2	Non-Fluoridated	793	793		1,586
			TOTAL (non-missing)	909	909	Yes	1,818
Sex	SEX	1	Male	510	510		1,020
		2	Female	399	399		798
			TOTAL (non-missing)	909	909	Yes	1,818
Age in Years	AGE	7	7 years	1	1		2
		8	8 years	2	2		4
		9	9 years	305	305		610
		10	10 years	220	220		440
		11	11 years	368	368		736
		12	12 years	13	13		26
			TOTAL (non-missing)	909	909	Yes	1,818
Examining Hygienist	EXAMINER	1	K M	175	197		372
		2	G L	91	100		191
		3	M W	439	461		900
		4	R B	105	130		236
			(missing)	(98)	(21)		(119)
			TOTAL (non-missing)	811	888	No	1,699

TABLE 2

VARIABLE NAMES DENOTING COUNTS OF NUMBERS OF AFFECTED TEETH

Type of Teeth (second letter)	Condition (final letters)	Treatment-Control (first letter)				Difference Treatment - Control (X)
		Treatment (T)		Control (C)		
Deciduous Teeth (D)	Previously Extracted (P)	TDP	*	CDP	*	XDP
	Crowns needing Extraction (C)	TDC	*	CDC	*	XDC
	Decayed (D)	TDD	*	CDD	*	XDD
	Filled (F)	TDF	*	CDF	*	XDF
	Total Affected (DEF)	TDDEF	*	CDDEF	*	XDDEF
	Extractions:					
	Extracted + Needed (E)	TDE		CDE		XDE
	Treated:					
Extracted + Filled (T)	TDT		CDT		XDT	
Permanent Teeth (P)	Previously Extracted (P)	TPP	*	CPP	*	XPP
	Crowns Needing Extraction (C)	TPC	*	CPC	*	XPC
	Decayed (D)	TPD	*	CPD	*	XPD
	Filled (F)	TPF	*	CPF	*	XPF
	Total Affected (DMF)	TPDMF	*	CPDMF	*	XPDMF
	Missing:					
	Extracted + Needed (M)	TPM		CPM		XPM
	Treated:					
Extracted + Filled (T)	TPT		CPT		XPT	
All Teeth (A)	Previously Extracted (P)	TAP		CAP		XAP
	Crowns Needing Extraction (C)	TAC		CAC		XAC
	Decayed (D)	TAD		CAD		XAD
	Filled (F)	TAF		CAF		XAF
	Total Affected (DMF)	TADMF		CADMF		XADMF
	Missing:					
	Extracted + Needed (M)	TAM		CAM		XAM
	Treated:					
Extracted + Filled (T)	TAT		CAT		XAT	

* These are the tooth counts recorded by the examining hygienist.

TABLE 3

FREQUENCY DISTRIBUTIONS FOR XAP, XAD, AND XAF SCORES AND
NORMALIZING TRANSFORMATION FOR XAD

XAP				XAD				Trans-	XAF			
Raw Diff.	Freq.	Pct.	Cum. Pct.	Raw Diff.	Freq.	Pct.	Cum. Pct.	formed Value	Raw Diff.	Freq.	Pct.	Cum. Pct.
									-13	1	0.1	0.1
									-12	2	0.2	0.3
									-11	7	0.8	1.1
									-10	5	0.6	1.7
									-9	5	0.6	2.2
-8	2	0.2	0.2	-8	1	0.1	0.1	-3.3	-8	11	1.2	3.4
									-7	23	2.5	5.9
-6	2	0.2	0.4						-6	38	4.2	10.1
-5	2	0.2	0.7	-5	1	0.1	0.2	-2.7	-5	41	4.5	14.6
-4	13	1.4	2.1	-4	12	1.3	1.5	-2.4	-4	61	6.7	21.3
-3	5	0.6	2.6	-3	6	0.7	2.2	-2.0	-3	55	6.1	27.4
-2	28	3.1	5.7	-2	47	5.2	7.4	-1.7	-2	67	7.4	34.8
-1	32	3.5	9.2	-1	78	8.6	16.0	-1.2	-1	61	6.7	41.5
0	757	83.3	92.5	0	639	70.3	86.2	0.0	0	103	11.3	52.8
1	25	2.8	95.3	1	70	7.7	93.9	1.2	1	70	7.7	60.5
2	19	2.1	97.4	2	28	3.1	97.0	1.7	2	88	9.7	70.2
3	10	1.1	98.5	3	17	1.9	98.9	2.0	3	67	7.4	77.6
4	13	1.4	99.9	4	3	0.3	99.2	2.4	4	50	5.5	83.1
				5	3	0.3	99.6	2.7	5	43	4.7	87.8
6	1	0.1	100.0	6	1	0.1	99.7	2.9	6	32	3.5	91.3
				7	2	0.2	99.9	3.1	7	31	3.4	94.7
									8	25	2.8	97.5
				9	1	0.1	100.0	3.5	9	10	1.1	98.6
									10	8	0.9	99.4
									11	2	0.2	99.7
									12	2	0.2	99.9
									14	1	0.1	
TOTAL	909	100.0	100.0	TOTAL	909	100.0	100.0		TOTAL	909	100.0	100.0
MEAN	-0.046			-0.020				-0.029	0.227			
S.D.	1.091			1.184				0.870	4.414			
S.E.	0.036			0.039				0.029	0.146			
SKEWNESS	-1.093*			0.668*				0.080	-0.036			
KURTOSIS	14.039‡			11.856‡				1.899‡	-0.182			
(Normalizing trans- formation would be inappropriate)				(for raw distribution)				(for normalized distribution)	(distribution is very close to normal)			

* Skewness departs significantly from normality (p<0.01, two-tailed test)

‡ Kurtosis departs significantly from normality (leptokurtic -- p<0.01, one-tailed test)

TABLE 4

DESCRIPTIVE STATISTICS AND MATCHED T-TESTS FOR NORMALLY DISTRIBUTED DIFFERENCE SCORES

Difference Score	Mean	S.D.	S.E.	N	t	2-tailed p	Skewness	Kurtosis
XDD (normalized)	-0.027	0.779	0.026	909	1.031	NS	-0.08	3.53
XDF	0.267	3.310	0.110	909	2.427	.015	-0.02	0.02
XDDEF	0.253	3.496	0.116	909	2.181	.029	-0.05	-0.11
XDT	0.267	3.416	0.113	909	2.362	.018	-0.05	-0.01
XPD (normalized)	-0.009	0.768	0.025	909	0.349	NS	0.12	4.08
XPF (normalized)	-0.018	0.975	0.032	909	0.563	NS	-0.11	-0.10
XPDMF (normalized)	-0.028	0.971	0.032	909	0.879	NS	-0.07	0.06
XPT (normalized)	-0.033	0.989	0.033	909	1.009	NS	-0.09	-0.07
XAD (normalized)	-0.030	0.870	0.029	909	1.021	NS	0.08	1.90
XAF	0.227	4.419	0.146	909	1.555	NS	-0.04	-0.18
XADMF	0.173	4.579	0.152	909	1.138	NS	-0.06	-0.28
XAT	0.180	4.531	0.150	909	1.200	NS	-0.07	-0.24

- Notes: 1) Raw difference scores were obtained by subtracting control scores from treatment scores for each matched pair.
- 2) Normalized difference scores were derived using Likert-type transformations. See, for example, the middle panel of Table 3.
- 3) All skewnesses are not significantly different from normality ($p > 0.05$, two-tailed test).
- 4) Kurtoses greater than 0.43 depart significantly from normality (leptokurtic -- $p < 0.01$, one-tailed test).

TABLE 5

DICHOTOMIZATION OF DECIDUOUS TOOTH SCORES FOR LOG-LINEAR ANALYSIS

Variable	Count	Frequency (Treatment) (N=909)	Frequency (Controls) (N=909)	Recoded Value For Log-Linear Analyses
Previously Extracted	0 ≥1	850 59	845 64	(not analyzed)
Needing Extraction	0 ≥1	889 20	897 12	(not analyzed)
Decayed	0 ≥1	821 88	809 100	0 1
Filled	0 1 2 ≥3	388 103 96 322	450 92 90 277	0 omitted omitted 1
Total Affected	0 1 2 ≥3	353 84 101 371	389 95 105 320	0 omitted omitted 1
Extracted	0 ≥1	833 76	837 72	(not analyzed)
Treated	0 1 2 ≥3	375 95 94 345	437 88 91 293	0 omitted omitted 1

TABLE 6

NUMBER OF MATCHED PAIRS BY GROUP AND AGE

Group			Age			Total
			9	10	11	
1.	1971	Complete Care	8	47	374	429
2.	1972	Complete Care	163	88	5	256
3.	1972	Preventive and Diagnostic Care	137	85	2	224
Total			308	220	381	909

TABLE 7

MULTIWAY FREQUENCY TABLE ANALYSIS - THE LOG-LINEAR MODEL

TWO-VARIABLE PARTIAL ASSOCIATIONS

A - TOTAL NUMBER OF DECIDUOUS TEETH AFFECTED

Variables in Analysis	Symbol	Number of Categories	Names of Categories
Total Affected	D	2	0, ≥ 3
Treatment/Control	C	2	Treatment, Control
Age	A	3	9, 10, 11
Sex	S	2	Male, Female
Examiner	E	4	KM, GL, MW, RB

Effect	Degrees of Freedom	Likelihood Ratio Chi-Square	Probability
DC	1	5.77	.0163
DA	2	122.51	<.0001
DS	1	5.30	.0213
DE	3	15.86	.0012
CA	2	1.17	.5581
CS	1	0.31	.5804
CE	3	0.98	.8068
AS	2	3.54	.1705
AE	6	56.65	<.0001
SE	3	9.96	.0189

B - TOTAL NUMBER OF DECIDUOUS TEETH TREATED

Variables in Analysis	Symbol	Number of Categories	Names of Categories
Total Treated	D	2	0, ≥ 3
Treatment/Control	C	2	Treatment, Control
Age	A	3	9, 10, 11
Sex	S	2	Male, Female
Examiner	E	4	KM, GL, MW, RB

Effect	Degrees of Freedom	Likelihood Ratio Chi-Square	Probability
DC	1	9.56	.0020
DA	2	100.76	<.0001
DS	1	5.16	.0231
DE	3	19.23	.0002
CA	2	1.05	.5912
CS	1	0.99	.3190
CE	3	0.87	.8316
AS	2	2.34	.3111
AE	6	56.73	<.0001
SE	3	8.12	.0437

TABLE 8

TWO-WAY MARGINAL TABLES SHOWING THE MOST SIGNIFICANT
TWO-WAY ASSOCIATIONS IN TABLE 7A

A - Treatment/Control by Total Affected (Effect DC)

Treatment/ Control	Total Affected		Total
	0	≥ 3	
Treatment	310	333	643
Control	377	317	694
Total	687	650	1,337

B - Age by Total Affected (Effect DA)

Age	Total Affected		Total
	0	≥ 3	
9	155	297	452
10	156	189	345
11	376	164	540
Total	687	650	1,337

C - Sex by Total Affected (Effect DS)

Sex	Total Affected		Total
	0	≥ 3	
Male	369	380	749
Female	318	270	588
Total	687	650	1,337

continued

TABLE 8 (continued)

D - Examiner by Total Affected (Effect DE)

Examiner	Total Affected		Total
	0	≥ 3	
KM	173	120	293
GL	94	52	146
MW	334	382	716
RB	86	96	182
Total	687	650	1,337

E - Examiner by Age (Effect AE)

Examiner	Age			Total
	9	10	11	
KM	95	87	111	293
GL	22	29	95	146
MW	244	204	268	716
RB	91	25	66	182
Total	452	345	540	1,337

F - Examiner by Sex (Effect SE)

Examiner	Sex		Total
	Male	Female	
KM	178	115	293
GL	82	64	146
MW	404	312	716
RB	85	97	182
Total	749	588	1,337

TABLE 9

VARIABLE NAMES DENOTING RATIOS OF NUMBERS OF EACH TYPE OF
AFFECTED TEETH TO TOTAL NUMBER OF AFFECTED TEETH

Type of Teeth	Condition (Numerator)	Treatment/Control		
		Treatment (T)	Control (C)	Difference Treatment -Control (X)
Deciduous Teeth (D)	Previously extracted (P)	TDP/DEF	CDP/DEF	XDP/DEF
	Crown needing extraction (C)	TDC/DEF	CDC/DEF	XDC/DEF
	Decayed (D)	TDD/DEF	CDD/DEF	XDD/DEF
	Filled (F)	TDF/DEF	CDF/DEF	XDF/DEF
	Extractions (E)	TDE/DEF	CDE/DEF	XDE/DEF
	Treated (T)	TDT/DEF	CDT/DEF	XDT/DEF
Permanent Teeth (P)	Previously extracted (P)	TPP/DMF	CPP/DMF	XPP/DMF
	Crown needing extraction (C)	TPC/DMF	CPC/DMF	XPC/DMF
	Decayed (D)	TPD/DMF	CPD/DMF	XPD/DMF
	Filled (F)	TPF/DMF	CPF/DMF	XPF/DMF
	Missing (M)	TPM/DMF	CPM/DMF	XPM/DMF
	Treated (T)	TPT/DMF	CPT/DMF	XPT/DMF
All Teeth (A)	Previously extracted (P)	TAP/DMF	CAP/DMF	XAP/DMF
	Crown needing extraction (C)	TAC/DMF	CAC/DMF	XAC/DMF
	Decayed (D)	TAD/DMF	CAD/DMF	XAD/DMF
	Filled (F)	TAF/DMF	CAF/DMF	XAF/DMF
	Missing (M)	TAM/DMF	CAM/DMF	XAM/DMF
	Treated (T)	TAT/DMF	CAT/DMF	XAT/DMF

TABLE 10

CROSSTABULATION OF NUMBERS OF AFFECTED TEETH FOR
TREATMENT AND MATCHED CONTROL

A - Deciduous Teeth		Control Total Affected (CDDEF)							Total
		1	2	3	4	5	6	≥7	
Treatment Total Affected (TDDEF)	1	15	6	6	8	3	3	9	50
	2	6	15	2	9	8	6	7	53
	3	8	8	3	8	4	4	9	44
	4	5	14	6	4	2	4	12	47
	5	6	7	4	4	6	4	6	37
	6	6	4	3	4	0	1	6	24
	≥ 7	11	9	8	9	9	7	15	68
Total		57	63	32	46	32	29	64	323

Number of matched pairs with both treatment and control

- having from 2 to 4 affected deciduous teeth = 69 pairs
- having 4 or more affected deciduous teeth = 93 pairs
- (overlap = 4 pairs)

..... continued

TABLE 10 (continued)

B - Permanent Teeth		Control Total Affected (CPDMF)							Total
		1	2	3	4	5	6	≥7	
Treatment Total Affected (TPDMF)	1	14	24	14	18	2	3	4	79
	2	14	16	16	29	4	3	3	85
	3	10	15	14	23	2	3	3	70
	4	20	29	17	35	7	4	3	115
	5	2	1	3	3	0	0	0	9
	6	0	1	2	2	0	0	2	7
	≥7	1	2	1	3	0	0	0	7
Total		61	88	67	113	15	13	15	372

Number of matched pairs with both treatment and control

- having from 2 to 4 affected permanent teeth = 194 pairs
- having 4 or more affected permanent teeth = 93 pairs
(overlap = 35 pairs)

..... continued

TABLE 10 (continued)

C - All Teeth		Control Total Affected (CADMF)							Total
		1	2	3	4	5	6	≥7	
Treatment Total Affected (TADMF)	1	8	3	5	7	5	7	18	53
	2	8	12	7	9	7	6	16	65
	3	11	10	11	10	3	12	29	86
	4	5	12	3	10	14	6	26	76
	5	4	10	9	13	4	5	13	58
	6	4	5	5	17	6	5	16	58
	≥7	16	31	22	19	21	25	63	197
Total		56	83	62	85	60	66	181	593

Number of matched pairs with both treatment and control

- having from 2 to 4 affected teeth = 84 pairs
- having 4 or more affected teeth = 263 pairs
- (overlap = 10 pairs)

TABLE 11

DIFFERENCES IN RATIO SCORES

A - For Both Treatment and Control Having From Two to Four Affected Teeth

Ratio	Mean	S.D.	S.E.	N	Skewness	% No Difference	Kurtosis
XDF/DEF	-0.006	0.228	0.027	69	1.08	89.9	15.38
XDC/DEF	-0.001	0.086	0.010	69	0.03	95.7	33.02
XDD/DEF	-9.048	0.415	0.050	69	-0.49	66.7	1.68
XDF/DEF	0.056	0.464	0.056	69	0.34	60.9	0.90
XDE/DEF	-0.007	0.244	0.029	69	0.91	85.5	11.62
XDT/DEF	0.050	0.432	0.052	69	0.54	66.7	1.35
XPP/DMF	-0.025	0.205	0.015	194	-1.60	91.8	14.84
XPC/DMF	0.002	0.035	0.003	194	4.39	98.5	68.40
XPB/DMF	-0.021	0.316	0.023	194	-0.13	76.8	4.93
XPF/DMF	0.044	0.385	0.028	194	0.14	70.6	2.43
XPM/DMF	-0.024	0.214	0.015	194	-1.38	91.2	13.32
XPT/DMF	0.019	0.318	0.023	194	0.14	77.3	4.76
XAP/DMF	-0.031	0.279	0.030	84	-0.24	84.5	7.56
XAC/DMF	-0.001	0.009	0.001	84	-9.17	98.8	84.00
XAD/DMF	-0.120	0.410	0.045	84	-0.49	72.6	1.82
XAF/DMF	0.152	0.493	0.054	84	0.00	59.5	0.46
XAM/DMF	-0.032	0.280	0.030	84	-0.23	83.3	7.54
XAT/DMF	0.121	0.410	0.045	84	0.49	73.8	1.83

..... continued

TABLE 11 (continued)

B - For Both Treatment and Control Having Four or More Affected Teeth

Ratio	Mean	S.D.	S.E.	N	Skewness	% No Difference	Kurtosis
XDP/DEF	-0.016	0.280	0.029	93	-0.73	58.1	3.55
XDC/DEF	-0.006	0.068	0.007	93	-2.70	91.4	19.55
XDD/DEF	-0.012	0.242	0.025	93	-1.15	64.5	6.25
XDF/DEF	0.034	0.390	0.040	93	0.35	36.6	0.97
XDE/DEF	-0.022	0.292	0.030	93	-1.04	53.8	3.52
XDT/DEF	0.018	0.261	0.027	93	1.05	62.4	5.89
XPP/DMF	-0.087	0.243	0.032	59	-2.40	79.7	6.70
XPC/DMF	0.001	0.030	0.004	59	1.91	96.6	30.65
XPD/DMF	-0.026	0.211	0.027	59	-0.26	76.3	6.47
XPF/DMF	0.112	0.340	0.044	59	0.50	59.3	2.28
XPM/DMF	-0.086	0.246	0.032	59	-2.32	76.3	6.42
XPT/DMF	0.026	0.225	0.029	59	-0.53	74.6	8.78
XAP/DMF	-0.017	0.230	0.014	263	-0.47	70.3	8.01
XAC/DMF	-0.002	0.049	0.003	263	-2.47	93.2	25.51
XAD/DMF	-0.008	0.218	0.013	263	-0.55	61.6	5.47
XAE/DMF	0.027	0.338	0.021	263	0.20	42.2	2.06
XAM/DMF	-0.019	0.239	0.015	263	-0.56	66.5	7.01
XAT/DMF	0.009	0.233	0.014	263	0.38	59.3	5.27

APPENDIX A

Canadian Dental Association Form D.H. 3, 1959

CHILDREN'S DENTAL CHARTING FORM (DH3)

IDENTIFICATION

Serial No. _____

Surname _____ Given Names _____ Address _____

1 Province _____ Birth Date _____

2 Metro Urban Town Rural _____

3 Municipality _____ Code _____ Birth Place _____

4 Male ☐ Female ☐ School _____

5 Age last birthday _____

6 Age when taking up residence _____

		Examination date	Col 1	Col 2	Examiner	Col 1	Col 2							
TOOTH DECAY	Deciduous	7a Pre.Lost			14 Orange or Green Stain	-	+	-	O. HYGIENE					
		8a Crown Lost			15 Materia Alba	-	+	-						
		9a Other Carious												
		10a Restored			16 Molar Relation	n	d	m		n	d	m		
		d.e.f.			17 Canines	n	post	n		post				
	Permanent	7b Pre.Lost			18 Crowding	-	U	L	-	U	L	MALOCCLUSION		
		8b Crown Lost			19 Drifting	-	+	-	+					
		9b Other Carious			20 Crossbite	-	A	P	-	A	P			
		10b Restored			21 Overjet 4 mm.	-	+	-	+					
		D.M.F.			22 Overbite or Openbite	n	+	upper	n	+	lower			
	D.M.F. + d.e.f.				23 Other Malocclusion	-	+	-	+					
	11 Lower First	Mesial Affected	0	1	2	0	1	2	24 Congenital	-	+	-	+	
		Buccal Pit Affected	0	1	2	0	1	2	25 Appliance	-	S	O	-	S
Molars Present		0	1	2	0	1	2	26 Fluoride	-	+	-	+		
PERIODONTAL	(a) Contour	n	h	a	n	h	a	27 Canadian Born	-	+	-	+		
	(b) Surface	P	S	P	S									
	(c) Colour	pink	red	blue	pink	red	blue							
	(d) Bleed	-	+	-	+			Notification	NTN	C	NTN	C		
	13 Other Periodontal	-						S	O	H&Pe	S	O	H&Pe	

BUCCAL OR LABIAL

8 7 6 5 4 3 2 1 1 2 3 4 5 6 7 8

Right Upper Left Upper

LINGUAL

e d c b a a b c d e

Right Lower Left Lower

8 7 6 5 4 3 2 1 1 2 3 4 5 6 7 8

BUCCAL OR LABIAL

Colour Date

Black col 1

Red col 2

☐ Surface carious
 ☐ Tooth absent with no successor in view
 ☐ Crown lost and/or tooth to be extracted
☐ Surface restored
 ☐ Gingival inflammation
 ☐ Tooth mobility

Canadian Dental Association, Form D. H. 3, 1959



